Warm Up # 5-3

The probability of flipping a head when a coin is tossed is: $\frac{1}{2}$

1. What is the probability of flipping two coins and getting a head on each?

2. Now we'll flip one coin and roll one die. What is the probability of flipping a tail and getting a six?

HW Questions: p. 59 & 62

Two Variable Statistics

Relationship between variables

Using pairs of Numerical data

Scatter Plots
Correlation
Line of Best Fit
Modeling

Using two Categories of data

Chi-Square Test of Independence

X^2

Today: The Chi-Square Test of Independence

First... a little vocabulary:

Chi: pronounced Kai, the capital Greek letter X.
Chi-Squared: X^2

Independent: When 2 variables are independent, one does not affect the other. The probability of one has no influence over the probability of the other.

From the warm up... Tossing a coin and rolling a die are Independent Events. The probability of flipping a tail had no influence over rolling a six!

The probability of 2 independent events both happening is simply the product of the 2 probabilities:

In the warm up we just multiplied:

Prob. of both = (Prob. of tails)(Prob. of a six)

$= \frac{1}{2} \cdot \frac{1}{6}$

$= \frac{1}{12}$

The probability of 2 Independent Events both happening = the product of the 2 probabilities.

	Graduated	Failed to Graduate	Total
Experimental	73	12	85
Control	43	39	82
Total	116	51	167

in total population

The probability of being in the Experimental group is: $\frac{85}{167}$

The probability of someone graduating is: $\frac{116}{167}$

If the events are Independent, then the probability of being BOTH in the experimental group and a graduate is:

$\frac{85}{167} \cdot \frac{116}{167} \approx 0.354$

	Graduated	Failed to Graduate	Total
Experimental	73	12	85
Control	43	39	82
Total	116	51	167

Now that we know the probability of being in both groups is: 0.354

How many students would we expect to be a graduate from the experimental group?

$$\left(\text{Prob. of both}\right) \cdot \left(\text{Total population}\right) = 0.354(167) \approx \boxed{59.1}$$

= Expected number of graduates in the experimental group if the events are Independent.

More Vocabulary...

H_0 = Null Hypothesis

A statement that the data sets are independent

H_1 = Alternate Hypothesis

A statement that the data sets are not independent

Matrix: An organized array of numbers

Contingency Table: A matrix arrangement of catagorical data.

Entries in the table represent the observed number of occurances (not percents). The entries are frequencies, so they are natural numbers, ℕ, (counting numbers)

Contingency tables are used to examine the relationship between two qualitative or categorical variables.

Our example:
Consider the experiment on the effectiveness of early childhood intervention programs.

	Graduated	Failed to Graduate	Total
Experimental	73 59	12	85
Control	43	39	82
Total	116	51	167

The table shows that people in the experimental condition were more likely to graduate than were subjects in the control condition.

Thus, the column a person is in (graduated or failed to graduate) is *contingent upon* (depends on) the row the person is in (experimental or control)

	Graduated	Failed to Graduate	Total
Experimental	73	12	85
Control	43	39	82
Total	116	51	167

Expected Table of Values

The calculated values you would expect if the variables are Independent

Contingency Table:

	Graduated	Failed to Graduate	Total
Experimental	73	12	85
Control	43	39	82
Total	116	51	167

Expected Value Table:

	Graduated	Failed to Graduate	Total
Experimental	A = 59.1	25.9	85
Control	56.9	25.1	82
Total	116	51	167

$$A = \underbrace{(\text{Prob. Exp})(\text{Prob Grad.})}_{\text{Prob of both.}}(\text{total pop.}) = $$ Expected # of students who grad from Exp

HW: 11E.1 p. 336,

1, 2ab, 3i

EXERCISE 11E.1

1 Construct an expected frequency table for the following contingency tables:

a

	Likes chicken	*Dislikes chicken*	*sum*
Likes fish	A = 45	15	60
Dislikes fish	30	10	40
sum	75	25	100

total pop.

$$A = \underbrace{\begin{pmatrix}\text{Prob.}\\ \text{likes}\\ \text{fish}\end{pmatrix}\begin{pmatrix}\text{Prob.}\\ \text{likes}\\ \text{Ch.}\end{pmatrix}}_{\text{Prob. of liking both}}\begin{pmatrix}\text{Total}\\ \text{pop}\end{pmatrix}$$

$$A = \frac{60}{100} \cdot \frac{75}{\cancel{100}} \cdot \cancel{100}$$

$$= 45$$